Record Status
This is a critical abstract of an economic evaluation that meets the criteria for inclusion on NHS EED. Each abstract contains a brief summary of the methods, the results and conclusions followed by a detailed critical assessment on the reliability of the study and the conclusions drawn.

CRD summary
The study examined the cost-effectiveness of stereotactic radiosurgery with or without whole brain radiation therapy for patients with brain metastasis. The authors concluded that radiosurgery with observation was a cost-effective strategy compared with radiosurgery plus whole brain radiotherapy. The validity of the data estimates used in the model was unclear and the methods were not fully transparent. It was difficult to judge whether the conclusions reached by the authors were a reasonable assessment of the study findings.

Type of economic evaluation
Cost-effectiveness analysis, cost-utility analysis

Study objective
To examine the cost-effectiveness of stereotactic radiosurgery with or without whole brain radiation therapy for patients with brain metastasis.

Interventions
The study assessed the cost-effectiveness of stereotactic radiosurgery with and without whole brain radiation therapy for patients with brain metastasis. Patients who did not receive whole brain radiation therapy were observed for their clinical outcomes.

Location/setting
USA/secondary care.

Methods
Analytical approach:
A decision-analytic model was used to synthesise evidence from a pivotal randomised controlled study and direct measures of patient utility data. The authors stated that a provider perspective of the study was taken (a tertiary care specialty cancer centre). The time horizon was 9.5 months, aligning to the median follow-up of the trial.

Effectiveness data:
The effectiveness data were based on a randomised controlled trial involving 58 patients randomly assigned to radiosurgery with or without whole brain radiotherapy and stratified by recursive-partitioning analysis class 1 or 2. The study recruited patients over a seven-year period (2000 to 2007). An intention-to-treat analysis was conducted. Recurrence rates were used at the two-year post study duration. Clinical outcomes included recurrence and progression rates. A cost-effectiveness protocol was planned from the onset and full clinical and neurocognitive outcomes were published (see Other Publications of Related Interest).

Monetary benefit and utility valuations:
Utilities were measured directly on the trial population using the time trade-off method and a study-specific questionnaire was designed. Three time expectancies were used (one-, five- and 10-year) which relaxed the rule of a fixed lifespan to adjust for death. Utilities were collected at baseline and two, four, six, nine, 12, 15, 18 and 24 months.

Measure of benefit:
The measures of benefit used were life-years saved and quality-adjusted life-years (QALYS). Given the short time
horizon, the measure was not discounted.

**Cost data:**
Direct patient-level medical costs were collected on the trial population and included those related to radiation oncology, surgical procedures, nursing and pharmacy. Cost values were derived from hospital records and calculated at the current procedural terminology level (CPT codes). Prices were presented in US dollars ($) 2007 after adjustment using the producer price index for general medical and surgical hospitals.

**Analysis of uncertainty:**
The model parameters were examined with one-way sensitivity analyses on the probabilities of treatment and outcome combinations (such as probability of a recurrence, treated and lived). One-way sensitivity analyses were presented in a tornado diagram. Further analyses considered radiation-related costs and surgery-related costs. A willingness-to-pay threshold of $100,000 was used for the analyses.

**Results**
Undiscounted mean costs were $74,000 for radiosurgery plus whole brain radiotherapy compared with $119,000 for radiosurgery alone. Corresponding mean life-years were 0.60 for radiosurgery plus whole brain radiotherapy compared with 1.64 for radiosurgery alone.

The incremental cost per life-year saved was $44,231 for radiosurgery alone compared to radiosurgery plus whole brain radiotherapy. Cost per QALY gained ranged from $41,783 to $44,064 depending on which utility value was used according to the year duration used as the terminal anchor in the time trade-off interviews.

Median survival was 15.2 months in patients who received radiosurgery alone compared with 5.7 months for patients who received radiosurgery plus whole brain radiotherapy (p=0.003). Recurrence rates were the key drivers in the model: 70% to 75% in the radiosurgery plus whole brain radiotherapy group versus 13% to 25% in the radiosurgery and observation group.

Findings from the one-way sensitivity analyses when variations to model probabilities were applied showed that the model was sensitive to the probabilities of having no recurrence or remaining alive in patients with recursive-partitioning analysis (RPA) class 2, increasing ratios up to $140,000 per QALY gained.

**Authors' conclusions**
The authors concluded that radiosurgery with observation was a cost-effective strategy compared with radiosurgery plus whole brain radiotherapy for patients with one to three brain metastases.

**CRD commentary**
**Interventions:**
The two strategies were not described in detail. Readers should decide whether the procedures are appropriate substitutes for each other, taking into consideration their safety profiles and approval for use in their own settings.

**Effectiveness/benefits:**
Brief demographic and clinical details of the pivotal trial used for the economic model were provided. Readers are referred to the separate publication of the key clinical outcomes (see Other Publications of Related Interest) to fully assess the internal validity of the results and applicability to their own population of interest. The measure of benefit collected was a preference elicitation method, which was appropriate.

**Costs:**
Unit costs were not presented in the report and the comparative resource quantities for the three strategies are unknown. Costs were based on institutional sources and it was unclear whether these were generalisable to other similar providers. Costs of surgical training and education and follow-up consultations seemed to be omitted from the study and the additional cost burden of these on the subsequent cost-effectiveness estimates was uncertain. The costs were appropriately adjusted for time and inflation.

**Analysis and results:**
The decision model was adequately described and a graph was included. The results were presented clearly. Some sensitivity analyses were undertaken; a probabilistic sensitivity analysis would have significantly improved the analyses and better addressed parameter uncertainty. It was unclear from this report what other therapies (such as chemotherapy) were used concurrently and may have confounded the survival outcomes. The authors highlighted some limitations of their study including reliance on a small single-study sample and variation in the time trade-off interviews to elicit utility values and stated that the results may not be applicable outside of a tertiary cancer centre where follow-up regimens were likely to be different.

Concluding remarks:
The validity of the data estimates used in the model is unclear and the methods are not fully transparent. It was difficult to judge whether the conclusions reached by the authors were a reasonable assessment of the study findings.

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